From Madeira to the Cape
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undertaken, so as to ensure sufficient light and secure resting-places for every piece of apparatus, however small.

The appliances for deep-sea work, most of them supplied by the Admiralty, comprised an ample supply of Miller-Casella thermometers, a certain number of Negretti and Zambra's reversing thermometers in Magnaghi frames, and several Challenger-type water-bottles for collecting samples at various depths. Most reliance will, however, be placed on the Pettersson-Nansen insulating water-bottle, which secures a sample of water and enables the exact temperature to be taken simultaneously. Three of these beautiful pieces of apparatus have been supplied, and they are expected to yield most important information as to the distribution of temperature and salinity with depth. I have also sent out a water-bottle on my own pattern for use in shallow water, for which it has certain special advantages.

Convenient cases for holding the thermometer and water-bottles, to be fixed on the after wall of the wardroom companion, were designed on board and made by the ship's carpenter, so that the instruments could be kept safely and conveniently on deck ready for use. Lieut. M. Barne takes charge of the deep-sea apparatus.

The Lucas sounding-machines of large and small size appear to be very well suited for their work; but the steam-gear for working the wire lines had not been fully tested while I was on board.

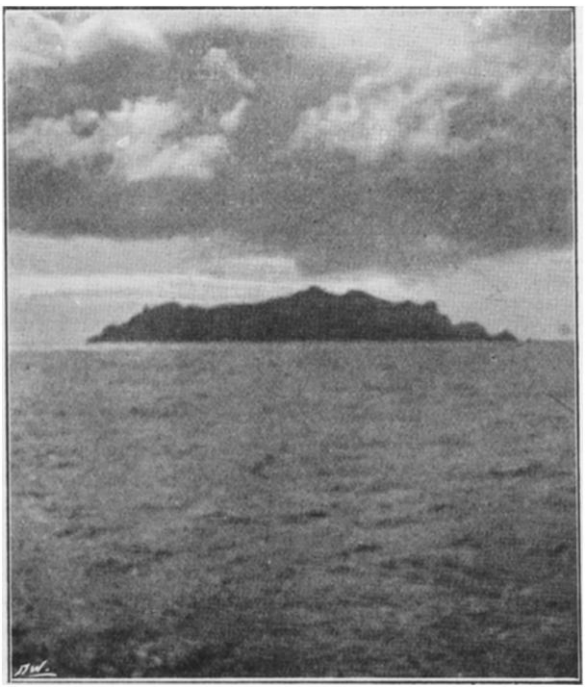
In this brief sketch reference has only been made to the parts of the work which came under my personal notice, or as to which I gave written instructions to supplement those contained in the 'Antarctic Manual.' I have said nothing as to the captive balloon, the platinum resistance thermometer, the whole magnetic equipment under Lieut. Armitage's charge, the physical apparatus to be used by Mr. Bernacchi, or about many branches of research which will be taken up if time and opportunity permit. And I have said nothing of the arrangements for biological work under the charge of my old friend Dr. Koettlitz and Mr. Hodgson. Over the arrangement of this department Mr. George Murray, the scientific director, personally presided, and I am indebted to him, as to all the officers and to every member of the scientific staff, for much kindness and the most hearty help in all my work on board.

II. FROM MADEIRA TO THE CAPE.

By GEORGE MURRAY, F.R.S.

THE first observation of general interest which I find in my scientific diary after leaving Madeira is under date August 22, obs. lat. 17° 22′ N., long. 20° 7½′ W. It is as follows: "The morning opened with every

visible sign of having been in the vicinity of a gale, and the meteorological observations coincided with these eye observations. . . . At noon there was a remarkable change in the appearance of the water, which I put down without hesitation to the presence of large shoals of diatoms. We started pumping (through tow-nets) at once, and the appearance of the net and the Murray-Blackman funnels confirmed this. So soon as it settled I made a brief examination, finding certainly many Peridinians (*Ceratium* and *Peridinium*), but, far outweighing these, an extraordinary quantity of broken-up organic refuse. Some of it



TRINIDAD ISLAND.

appears to have been digested and excreted by marine crustacea, etc., but most of it looks like decomposed matter from a river, broken-down fragments of vegetation too much decomposed for determination. There are large numbers of bacteria. I inquired our position, and we are about 120 miles off the African coast. The Senegal river is hardly equal to this. I am therefore driven to alternative explanations, viz. an offshore gale, as at present indicated by the meteorological observations, into the effect of which we have run, or an upwelling of inland waters, such as that recorded by Mr. Benest in these parts on the Silvertown Company's ship *Dacia*. The surface temperature is 81°;

the 8 a.m. temperature was 77°·5. Lieut. Shackleton gives the density at 15° 56′ C. = 1·02685, the salinity at 84° F. = 20·75." I commenced that evening a prolonged microscopic examination of this water, finishing at 2 a.m. next day. The result I note as follows: "Most of the organic *detritus* is unrecognizable, but with it now and then there are particles which indicate an origin from land waters. However, this is in small proportion, and it would be dangerous to conclude that this great body of matter had an exclusively land origin. There are more Peridinians in it than I at first thought. It appears that there is commonly here a large patch of greenish-yellowish water, and there is certainly a case for farther investigation, not only of the surface, but of the lower layers by water-bottle." Very soon after 8 a.m. on the next day (lat. 15° 25′ N., long. 20° 25′ W.) we noticed a distinct change in the colour of the sea, and by noon it had regained its normal blue to the casual eye. I append the readings by Dr. Wilson of Forel's xanthometer (adjusted previously by Dr. Mill).*

17	August,	noon	...	...	...	...	5	per cent.	yellow
18	„	„	...	...	...	...	5	„	„
19	„	„	...	...	...	...	7	„	„
20	„	„	...	...	...	...	7	„	„
21	„	„	...	...	...	...	9	„	„
22	„	8 a.m.	...	...	...	...	9	„	„
22	„	noon	...	...	...	...	30	„	„
23	„	8 a.m.	...	...	...	...	50	„	„
23	„	noon	...	...	...	...	9	„	„
24	„	8 a.m.	...	...	...	...	5	„	„
25	„	8 a.m.	...	...	...	...	5	„	„
26	„	8 a.m.	...	...	...	...	5	„	„

Work was now getting reduced to a system, and general directions for all hands, naval and scientific, were drawn up and inscribed in the Order Book by Captain Scott and myself. The most splendid spirit declared itself. While Captain Scott occupied extemporized quarters in the port laboratory, engrossed with his new-found study of the microscope, in which he became miraculously expert almost at once, as did Lieut. Royds, I found myself interested more and more in affairs only verging on my province, and occasionally occupying positions our Commander kindly thought inconsistent with my duty as the parent of a family.

Not only was the general efficiency of the staff in progress, but we began to interest and educate the men in the work of the Expedition, and a weekly course of lectures was begun with lantern slides and microscopic demonstrations to heighten their interest. This

* On my homeward passage in the *Briton*, I found much closer in shore, at the same latitude, precisely similar conditions, and I wish to record these observations in the hope they may be followed up.

immediately had an excellent effect, and I found myself beset with later inquiries as to the meaning of this or that apparatus, or what was the place of some organism in the economy of sea-life, that were as gratifying as they were often puzzling. All this excellent good feeling was kept up without one single break in the "horse latitudes," where one day we collected fifteen tons of rain-water from the deck.

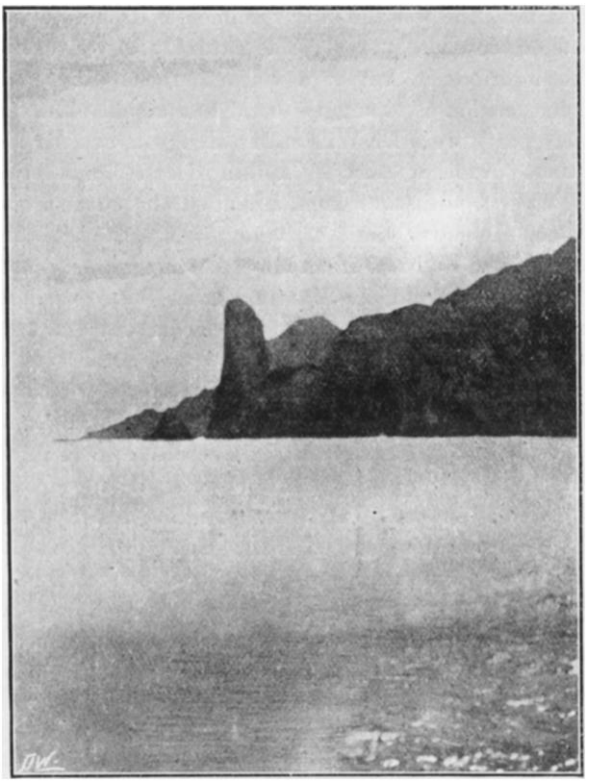
So soon as I observed that our projected course lay near the island of South Trinidad, I entertained the hope that we might be able to effect a landing on so interesting a spot. Its interest to the naturalist lies in the fact that it is an oceanic island of considerable elevation, and some hundreds of miles from the nearest land of any extent, and, but for abortive attempts to settle on it, was uninfluenced by man. Halley (astronomer-royal) landed on it April 17, 1700, and put on it some goats and hogs, and a pair of guinea-fowl from St. Helena. An English attempt to settle on it was made in 1781, and a like unsuccessful settlement was tried by the Brazilians * at a later date. Other recorded landings are by Amaso Delano (1803), Sir James Clark Ross (1839); and doubtless the island has been frequently visited for a few hours at a time by the crews of sailing and other ships. Our sailmaker told us of such landings, and Captain Scott found near our landing-place a record of a visit by H.M.S. *Ruby* in 1889. Most of the above particulars are taken from the 'South American Pilot,' part i. 4th edit. (1893), p. 43, which also records a visit by Captain Buckle in H.M.S. *Growler* in 1844, and from Mr. E. F. Knight's 'Cruise of the *Falcon*.' Mr. Knight spent some time on the island, and gives the only detailed account of it known to me (*loc. cit.*). I have read his 'Cruise of the *Alerte*' since my return.

The island is in lat. 20° 30′ S. long., 29° 22′ W. (approx.), is about 3 miles in length (north-west and south-east), and about 1¼ in breadth. It consists of a rugged mass of tumbled volcanic rock, the central peak rising, according to the 'South American Pilot,' to 3000 feet, and according to the Admiralty chart, 2020 feet. The Martin Vaz islets, about 26 miles distant from South Trinidad, are three small barren rocks which have no influence on the fauna and flora of South Trinidad. The picturesque account of Mr. Knight's adventures on the island is easily accessible and well known, and had no small influence on the more adventurous members of our party in whetting their appetite for a "run ashore" on it. The opportunity which it would afford of exercising the observing and collecting powers of our company was the main serious purposes of our landing, though the mere pleasure of the undertaking was shared by all alike, commander, officers, and men. It was easy to tell at a glance at the men who were appointed to land and who were not. One bluejacket is reported to have wept in vexation

* ? Portuguese.

at being left behind. There was a lingering fear, begotten of the navigator's chaff, that we might after all miss this minute oceanic islet in the night, and all hands were comforted by the bright and early intimation at 5 a.m. that land was 20 miles right ahead.

During the next few hours sketchers and photographers were busy, and Dr. Wilson's coloured drawings of the approach to the island render most accurately the dream-like appearance of this remarkable cluster of volcanic peaks in the early tropical dawn. To some of us the out-



COAST OF TRINIDAD ISLAND.

line suggested an early morning view of the old town of Edinburgh, culminating in the Castle Rock; others, perhaps more happily, thought of Arran from the north or north-east. A nearer approach showed our scenery to be wilder and more inhospitable—to be, in fact, the Trinidad of our impressions from Mr. Knight's narrative. But the business in hand began to claim attention.

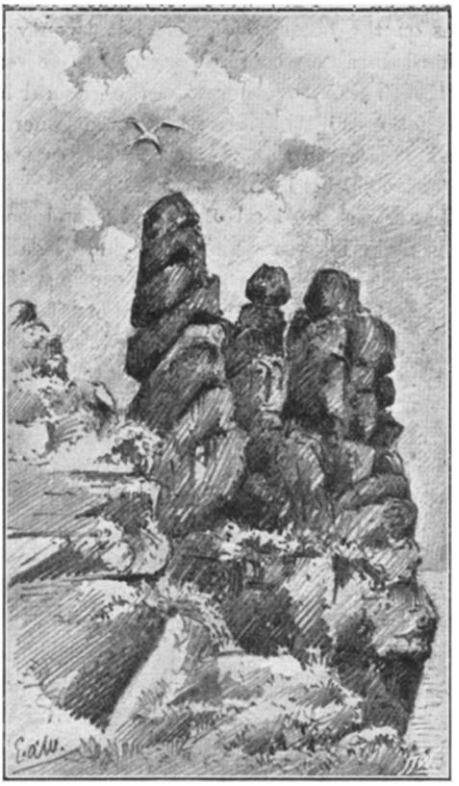
At 10.30 a.m., according to plan, two whale-boats left the ship. The first, in charge of Captain Scott, contained Dr. Koettlitz, Mr. Hodgson, Mr. Skelton, and myself; the second, in charge of Lieut. Royds,

carried Lieut. Shackleton, Dr. Wilson, and Mr. Ferrar. The proposal was to land near Mr. Knight's cascade, at a rock which he describes as forming a natural pier. To judge by the surf along the coast, it was the only possible landing-place in sight, and, as we approached, it offered few attractions. By anchoring the boats and backing in, all landed without mishap, and our equipment was passed ashore. Two hands were left in each boat with fishing-lines, and I may mention they had excellent sport during our absence, securing forty-four *Balistes* and two small sharks. Forty-three of the *Balistes* were of the same species, and the remaining one was the only specimen of its kind obtained either by the boats or the shore party. The natural pier was not of coral, as Mr. Knight describes it, but of a volcanic rock, which was worn in places in such fashion as to suggest coral to a casual observer.

The shore party were Dr. Wilson, Mr. Hodgson, and Mr. Ferrar, with several hands. Another party, Captain Scott, Dr. Koettlitz, Lieut. Royds, and myself, with four men, ascended the ravine, reaching the tree-fern zone, the lower limit of which was 1090 by both aneroids. Mr. Skelton reached by himself an elevation at another place where he could see, across the island, the Martin Vaz islets on the horizon; and Lieut. Shackleton, also by himself, followed on our track as far as a plateau at the foot of the high waterfall where the stream emerges from the forest of tree-ferns. I shall take each party's story by itself.

Our party found very little of interest at first, the piled-up rocks being partly covered with a coarse *Cyperus*, and here and there in the crevices grew a fern. Another very wiry plant (*Fimbristylis*) appeared higher up, but sparsely, and at about 400 feet another fern. I scraped some fresh-water algæ from stones in the bed of the stream, which was low, though the banks show that at times it must be a deep torrent, here and there branching out into other channels now dry. Two lichens were fairly abundant on the stones and on the trunks of the numerous dead trees, described by Mr. Knight from this and other valleys. These trunks (*Cæsalpinia* sp.) have plainly been dead for many years, and are bleached white, and for a great part covered with lichens. The wood is a hard red wood, and, from the abundance of the trunks, they must represent a considerable forest, now vanished from the island. Dr. Koettlitz was busy all the way up collecting flies, spiders, dragonflies, etc., which were abundant considering the scarcity of vegetation. Mr. Knight appears to have observed no insects. We obtained a few earth-worms here and there, and I should say they were unexpectedly common. At the plateau at the foot of the high waterfall we turned to the right, and, ascending by a precipitous route, reached a ledge, along which we passed to the left to the tree ferns, and stopped in the bed of the stream where it issues from the tree-ferns to fall over the face of the precipice. Some way down the sheer face of this cliff, we observed the basaltic rock take a columnar form, not quite perpendicular, but emerging at an angle from

the rock face. On the way up I collected a sage without flower, which was the only phanerogam, besides the two *Cyperaceæ* and the dead trees, we met with. There was a fair amount of vegetation, but a perfectly amazing lack of variety. Considering the island's favourable situation from a climatic point of view, this barrenness is scarcely credible. Land-crabs simply swarmed all the way up, and I am bound to confess they did not make upon us the same weird impression that Mr. Knight



HEADLAND OF FRIABLE BLACK ROCK, TRINIDAD ISLAND.
(*From Sketch by Mr. Wilson.*)

experienced. Possibly we regarded them simply from a naturalist's point of view. Dr. Koettlitz and some of the men fed them at lunch-time, and of course we collected suitable specimens. Bird-life—especially petrels—was everywhere abundant. Birds hovered about our heads, and when we stopped, perched close beside us. They were quite easily taken by the hand, in butterfly-nets, etc.

On reaching the tree-ferns, I expected to find under their shelter a profusion of mosses, hepaticæ, lichens, etc., but even there the same

barren character was maintained. A few small ferns, fern prothallia, and some filamentous green growth, which may be the sporogonium of a moss or a small alga, were growing near the stream where it passed through the ferns. I cut down and brought with us a small tree-fern. The average height was from 12 to 15 feet, though I should say that a few were markedly higher.

My first impression was that the dead tree-trunks were the remains of a forest the trees of which had perished from some fungus or insect plague many years ago. They were very much in the condition Mr. Knight describes on the occasion of his visit twenty years ago. The wood is a very hard durable wood, and seemed to be very little invaded by fungus growth. Taken together with the general barrenness of the vegetation, I cannot escape the idea that some general destruction of vegetation has taken place in this valley, possibly over the whole island, and that its present condition represents a struggle back again to the normal state. There was no sign of the pigs and goats which at one time were landed on the island. One cannot help recalling the destruction of trees in St. Helena by goats as recorded by Mr. Darwin in the 'Voyage of the *Beagle*.' Has some such action taken place here with the result that the climate has been changed, and the general vegetation impoverished with a reaction involving the extermination of the goats themselves?

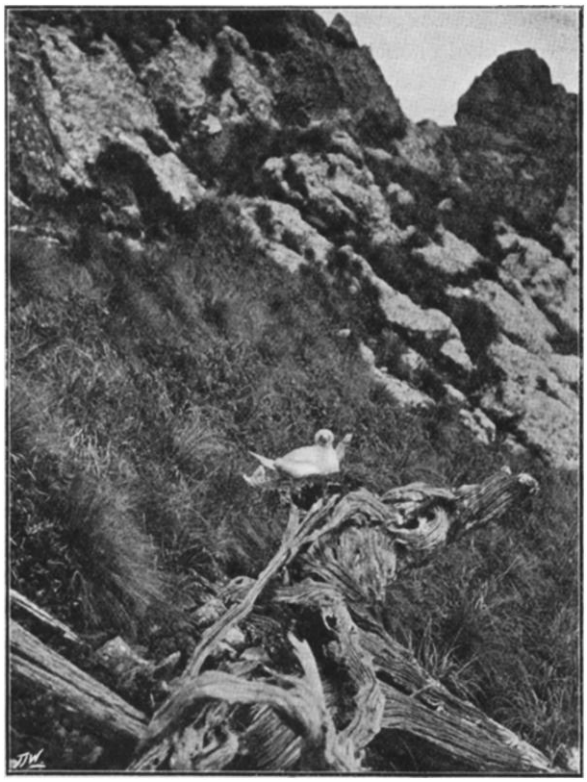
Our party reached the general rendezvous on the shore at 4.30, after an exhausting climb. The tide had risen, and we were cut off from the place of meeting by a high rocky point, which had to be climbed after an attempt by Captain Scott and myself to wade round it. Respect for specimens, camera, gun, etc., caused us to abandon this when we found the water breast-high.

Lieut. Shackleton, who had followed us, made an interesting and useful general collection and an acute series of observations. He obtained from a gannet's nest a specimen of a leguminous plant, no doubt the kind referred to by Mr. Knight as growing on the other side of the island, from which the bird had transported it. He took water-samples from the streams, and has since analyzed them, and obtained some photographs of birds and their nests. Like the rest of us, he was too heavily laden for climbing easily among the rocks.

Mr. Skelton made an adventurous journey by himself—a rash proceeding in such a place—eventually reaching a point where he could see across the island, though nowhere near the highest point. He went eastwards in the direction of the Monument, and steadily pursued his special task of observing and collecting birds and their eggs. In this he was particularly successful. On returning, he, on his part, was also cut off by the tide, and found himself in a very dangerous situation, where he could neither advance nor retreat. He managed to lower his gear, and then climb up the cliff and work his way round,

arriving just as the whole party was assembled. He had carried too much, and in the later stage of his journey suffered from cramp. His bag was 7 petrels and 4 eggs; 4 gannets and 3 eggs; 4 terns and 3 eggs. Unfortunately, these eggs were broken in the boat on returning.

On the reassembly of the whole party at the rendezvous, the tide was found to have cut us off from the "natural pier" mentioned—it was a very natural pier indeed—but it was safely reached through the surf, the first waders carrying out a line with them. As the faithful



GANNET'S NEST ON TRINIDAD ISLAND, 1100 FEET.

Cross led the way, I followed him, and we had the reward of our temerity in getting off very cheaply—the rest of the party thoroughly enjoying their varying fortunes. One member fought a little shy of the ordeal, and deservedly came off worst, to the huge delight of his friends. The whole party reached the *Discovery* at 6.10 p.m.

Lieut. Armitage had swung the ship during our absence, and Lieut. Barne had practised with sounding-gear, water-bottle, etc. Before setting out in the morning a fish-trap had been lowered and buoyed,

On hoisting it in, it was found to contain only the bait. Nothing was caught by the hand-lines from the ship—two negative results that are surprising after Mr. Knight's experience in the *Falcon* and that of our men in the boats close in shore.

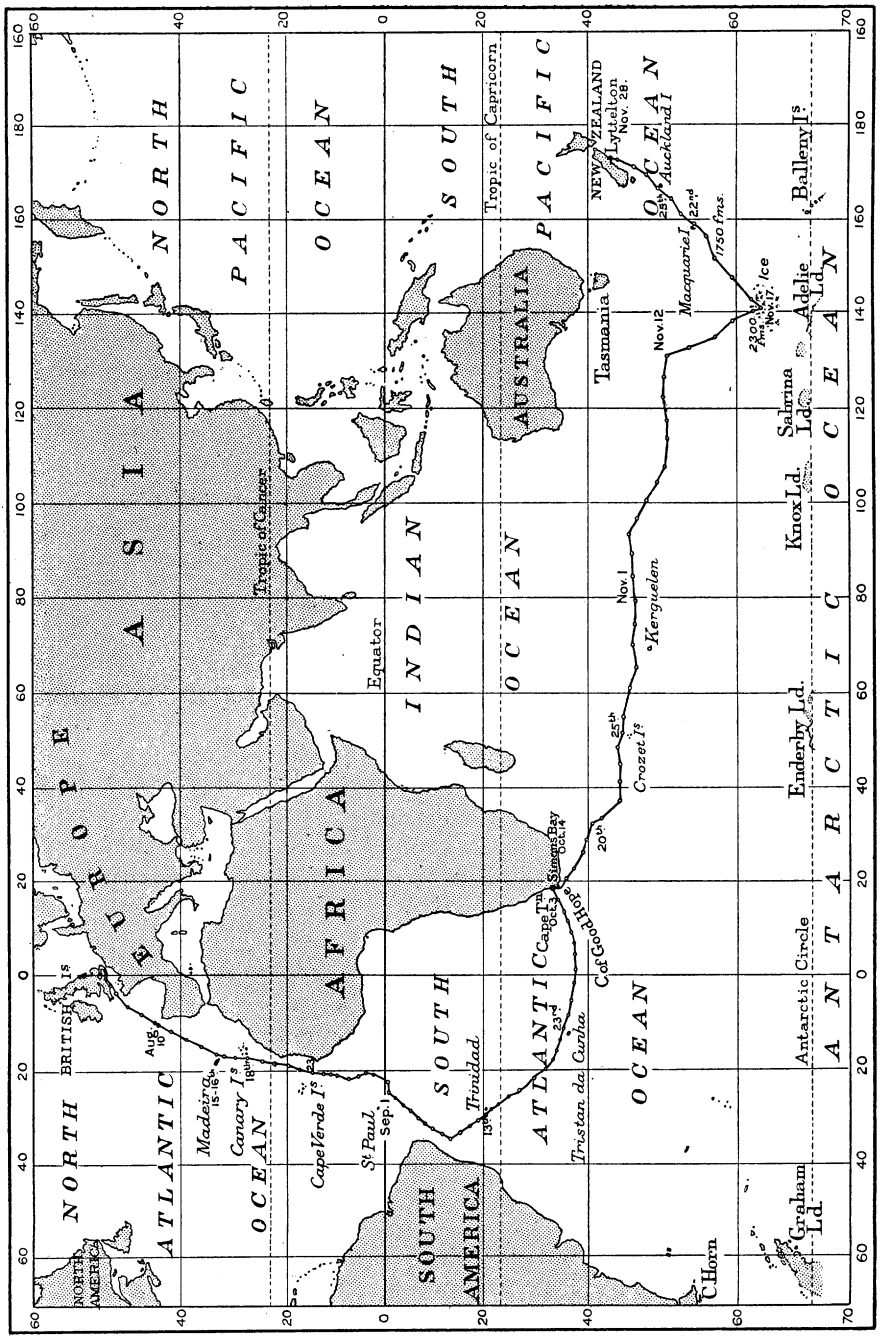
Mr. Ferrar made an interesting series of geological observations, and his specimens have been examined by Mr. G. T. Prior of the Mineral Department of the British Museum. Mr. Prior recently examined the specimens collected by Sir James Clark Ross on his outward voyage, and has, I fear, anticipated Mr. Ferrar's observations. In his paper in the *Mineralogical Magazine* (vol. xii. No. 58) he describes the Ninepin rock as of phonolite, and quotes Mr. Knight's description of the whole island as rotten and toppling to pieces—a very graphic description of the place. He goes in detail through the mineral structure of the island, and makes an interesting comparison of it with Fernando Noronha. "The characters of these rocks, as well as many of the geological features of the island, such as the remarkable peaks of phonolite associated with basaltic lavas, suggest analogies between Trinidad and the island of Fernando Noronha, off the coast of Brazil, a thousand miles to the north, so that it appears possible that the two islands owe their origin to a very similar, if not contemporaneous, volcanic outbreak." In a letter he says of Mr. Ferrar's specimens, "The rocks do not differ much from those collected by the Ross expedition," and in this department we have been unluckily anticipated.

I have already alluded to the extreme barrenness of the island from a botanical point of view. Two plants belonging to the Cyperaceæ, both endemic, clothe the valley we ascended. The predominant form is *Cyperus atlanticus*, Hemsl., and a rarer form is *Fimbristylis nesiotis*, Hemsl. Dr. Copeland, the astronomer, landed here in 1874, and collected a number of plants referred to in the *Challenger Reports*, Botany, iii. p. 123, by Mr. Hemsley. He was more fortunate in some respects than we. He obtained nine phanerogams, four ferns, and four lichens. The tree-fern, which forms so remarkable a feature of the higher ground, is *Cyathea Copelandi*, Kuhn and Luerss., also an endemic species. In addition to the ferns found by Dr. Copeland, we found three others, *Pteris palmata*, a *Nephrodium*, and another not yet determined, besides a moss (*Isopterygium*) and an Hepatic (*Eulejeunea*).

Even the fresh-water algæ from the cascade give barren results. We got three lichens, *Ramalia anceps*, Nyl., a West Indian form; *Usnea barbata*, var. *rubigina*, Meyer and Fest., a very widely distributed form; and *Parmelia latissima*, Fee, var. *insidiosa*, Müll. Arg., also widely distributed. The bean collected by Lieut. Shackleton from a bird's nest, and so often referred to by Mr. Knight in his later book, 'The Cruise of the *Alerte*,' is *Canavalia obtusifolia*, L., a widespread tropical form, also obtained on the island by Dr. Copeland.

Sir George Hampson informs me that it will take a long time to

TRACK OF THE S.S. "DISCOVERY," FROM COWES, AUGUST 6TH,
TO PORT LYTTELTON, NOVEMBER 28TH, 1901.



work up the insects. Mr. Pocock furnishes me with the following note: "The spiders collected in the island of Trinidad are referable to five species, of which I have been able to identify only two—namely, *Heteropoda venatoria*, the ubiquitous house-spider of the tropics, and *Tetramatha nitens*, Aud., also a widely ranging tropical form. There are also two specimens of a *Plexippus*-like attoid spider, one example of species of *Aranea*, and several immature specimens of a species of *Leucauge*." Mr. Knight frequently refers to the land-crabs as "loathsome" and "unlike any I have ever seen," etc. They are quite common and widely distributed. The two crabs we found—and they made no terrible impression upon us — are *Gecarcinus lagostomus* and *Grapsus maculatus*. The fishes obtained by Mr. Hodgson and the men in the boats are: *Muraena punctatofasciata*, Blkr.; *Epinephelus merra*, Bl. *Glyphidodon bengalensis*, Bl.; *Platyglossus cyanostigma*, C. and V.; *Clinus nuchipinnis*, Q. and G.; *Acanthurus chirurgus*, Bl. Schn.; *Balistes buniva*, Lacép.; *Balistes maculatus*, Gm.; as determined by Mr. Boulenger. They are all well known, and call for no special remark.

The birds belong to seven species, of which one petrel appeared to be new to science, and Dr. Bowdler Sharpe had named it *Œstrelata wilsoni*. The other species, which was found nesting at a higher elevation than *O. wilsoni*, was *O. trinitatis*, a petrel discovered by the *Magenta*, and not hitherto represented in any museum in this country. The frigate-bird procured was, curiously enough, the smaller species, *Fregata ariel*, and not the larger one, *F. aquila*, which was the species met with on South Trinidad by the Earl of Crawford in the *Venus*.

Mr. Knight's description of South Trinidad as "the hottest, most depressing, and uncanny spot on earth" is no exaggeration, but the place, apart from its unfound piratical treasures, has a fascination for the naturalist that is not abated by the discomforts of travelling over it.

Perhaps the principal excitement of our southward voyage was the constant experiment with protected tow-nets. One evening I drew the plans of Mr. Blackman and myself of a torpedo-shaped protected net. Captain Scott summoned the carpenter, and it was at once put in hand. It answered fairly well, but the trials were hardly in progress before he began a fresh series of experiments with canvas covers instead of wooden shields. In fact, between microscopical work and tow-netting, I began to feel the captain was rapidly usurping the director's place, and it gave me unqualified pleasure to know that these departments would be so enthusiastically looked after when I had left the ship. The rival nets were still in competition when Captain Scott made a most important invention, viz. that of very long and very narrow nets without any protection. With these (which I shall describe elsewhere) we were able to tow-net up to 10 knots without any protection whatever. They were so successful that we for the time abandoned all the experiments with protected nets.

Two events relieved the monotony of the later stages of our voyage. One was the discovery by Dr. Koettlitz of a new Peridinian, which was named *Peridinium Scottianum* after our commander. The other was the capture by myself of a new generic type of pelagic unicellular alga. There was a general petition to call it after the ship, but I think the ship will yet be commemorated in this way, and I prefer, with the President's permission, to call this first generic type *Markhamia pelagica.*

Looking through my scientific diary, I find much to interest the naturalist—less of general interest, and in my private diary nothing that would be other than merely humorous.

III. THE "DISCOVERY" AND THE RELIEF SHIP.

By Sir CLEMENTS R. MARKHAM, K.C.B., F.R.S., President R.G.S.

WHEN the National Antarctic Expedition left Simon's bay, it may be considered to have entered upon its real work. During the fifty-two days of the voyage thence to New Zealand experience was acquired respecting the adaptability of the ship to her work, respecting the qualifications of officers and men, and respecting the organization of all the various scientific investigations.

Favourable and hopeful reports on all these points cannot fail to encourage us in our hopes for the success of the great enterprise on which this Society has entered, in conjunction with the Royal Society.

First, with regard to the design of the ship. The spell of bad weather from October 27 to November 3, when a succession of westerly gales were experienced, was the first real test of the ship's seaworthy qualities. From this point of view she proved entirely satisfactory. At times it blew very hard, with heavy cross-seas, and the squalls burst in violent gusts of wind and hail or snow. It was found that the good ship rose easily and lightly to the heaviest seas, was wonderfully stiff under canvas, and surprisingly dry. Captain Scott had expected the possibility of shipping seas over the stern when running before heavy weather, and consequently some risk of broaching to. He was, therefore, agreeably surprised to find that no such danger exists. The ship has proved to be, in all respects, an excellent sea-boat. For this the Societies have to thank Mr. W. E. Smith, the designer, and one of the chief constructors of the Navy. He has given us his experience and his great abilities, almost as a labour of love, and has designed for us by far the best ship that ever entered the polar seas. He not only had to consider the lines of modern polar ships, but he also had to take into account the extreme difference of sea conditions between the